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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,896	05/16/2006	Renato Bugge	BRW-002USRCE2	1816
959 7590 11/12/2010 NELSON MULLINS RILEY & SCARBOROUGH LLP FLOOR 30, SUITE 3000 ONE POST OFFICE SQUARE BOSTON, MA 02109				
EXAMINER				
LANGMAN, JONATHAN C				
ART UNIT		PAPER NUMBER		
1784				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/540,896

Applicant(s)

BUGGE ET AL.

Examiner

JONATHAN C. LANGMAN

Art Unit

1784

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 November 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) 1-23 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 24-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/22)
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____
- Paper No(s)/Mail Date: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 3, 2010 has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 24-31 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 24 recites that the oxidizing agent is present in an amount of 0.4-5.3 weight percent. Applicant points to appendix A, page 13 of the Remarks submitted November 3, 2010, for support of these ranges from the originally filed specification.

However, the ranges of 0.4-5.3 are not weight percents, as claimed, and are instead weight percents/volume, g/ml, a density.

Furthermore, the conversions used to obtain these numbers appear to be in error. It appears the applicant is using incorrect densities for the respective constituents to convert milliliters to grams.

Hydrogen Peroxide

9.8 Mol H_2O_2 as described in Appendix A, and in the instant specification is diluted hydrogen peroxide with a concentration of 30% H_2O_2 . 30% hydrogen peroxide has a density of 1.1122 g/ml. However the applicant uses 0.33g/ml to convert ml of hydrogen peroxide to grams.

*****Examiners Note: Applicant is directed to Millero et al. ("Oxidation of H_2S with H_2O_2 in Natural Waters"), page 209, col. 2, line 19, to show that 9.8M H_2O_2 as disclosed in instant specification, and in Appendix A, is equivalent to 30% H_2O_2 . Applicant is then directed to Behnajady et al. ("Investigation of the Effect of Ultrasonic Waves on the enhancement of efficiency of direct photolysis and photooxidation processes on the removal of a model contaminant from textile industry"), page 9, section 2.1, line 3, which teaches that 30% hydrogen peroxide has a density of 1.11g/ml.

Hydrofluoric Acid

22.5M HF as described in Appendix A, and in the instant specification, is diluted Hydrofluoric acid with a concentration of 40% HF. 40% HF has a density of 1.13g/ml. However the applicant uses 0.45g/ml to convert ml of HF to grams.

*****Examiner's Note: Applicant is directed to Caletka et al. ("Trace Characterization of Tantalum by NAA Involving Pre and Post Irradiation Separations"), page 327, line 3 to show that 22.5M HF as disclosed in instant specification, and in Appendix A, is equivalent to 40%HF. Applicant is then directed to <http://www.erowid.org/archive/rhodium/chemistry/equipment/molarity.html>, wherein the first table shows that 40% HF has a density of 1.13 g/ml.

Lactic Acid or Acetic Acid

The examiner was unable to obtain densities of 2.5M citric and lactic acid, to convert ml of 2.5M citric acid and 2.5M lactic acid to grams. However, believes that the density of 0.48 g/ml used in the applicants conversion is also in error, since 2.5M citric acid as well as 2.5M lactic acid are acids diluted in water, wherein water has a density of 1 g/ml, and citric acid and lactic acid both have densities larger than 1.0 g/ml.

Based on these incorrect densities used to convert the applicants claimed constituents to weight percent, the examiner contends that the applicant is not supported for the claimed weight ranges.

Furthermore, the claim sets forth that the ranges are in weight percent, however Appendix A which is used to support these claimed ranges is in densities, wherein the applicant divided grams of H_2O_2 by the total amount of ml's used in the solution, to obtain a range of 0.4-5.3 g/ml.

To obtain weight percents, applicant would need to divide the converted grams of H_2O_2 by the total number of grams in the etchant solution.

Claims 25-31 are rejected for being dependent upon a base rejected claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mishurnyi et al. (Multicomponent Sb-Based solid solutions grown from Sb-Rich liquid phases") in view of Wu et al. ("Sulphur Passivation of the InGaAsSb/GaSb Photodiodes").

Mishurnyi et al. teach a system comprising an AlGaInAsSb quinary semiconductor material (abstract) with a composition of $Al_xGa_{1-x-z}In_zAs_ySb_{1-y}$ (page 38 second paragraph), wherein x, y, and z fall within the applicants instantly claimed ranges. Mishurnyi teaches using the layer in lasers. Mishurnyi does not teach that the

system comprises a wet etchant for wet acid etching a portion of the semiconductor material. Wu et al. teach an electronic semiconductor device comprising layers of InGaAsSb, for use in LED's, lasers, Photodiodes, etc. (pg 1303, col. 1, lines 1-4). To form these structures Wu et al. teaches etching the layers with a wet etching solution comprising, HF:Tartaric acid:H₂O₂:H₂O in amounts of (5ml:1.2g:10ml:160ml) (pg 1303, col. 1). A table showing these material densities, and their conversion to weight percents is provided below.

Concentration	Material	density (g/ml)
100%	HF	1.0005
100%	H2O2	1.4465
100%	Tartaric Acid	1.79
	Water	1

Wu	Etch Material	Amount	in grams	wt%
	HF	5ml	5.0025	2.77
	H2O2	10ml	14.465	8.01
	Tartaric Acid	1.2g	1.2	0.66
	Water	160ml	160	88.56
	Total		180.6675	100

Therefore Wu, teaches a wet acid etchant comprising organic acid; an oxidizing agent in an amount of 8 weight percent; hydrofluoric acid; and water.

An oxidizing agent in an amount of 8 weight percent; weight percent falls outside the claimed range of 0.4-5.3%. However, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties.

An oxidizing agent in an amount of 8 weight percent; is substantially close to that of the instant claims one of ordinary skill would have expected compositions that are in

such close proportions to those in prior art to be prima facie obvious, and to have same properties (*Titanium Metals Corp.*, 227 USPQ 773 (CA FC 1985)).

It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to use this etching system taught by Wu et al as an etchant for etching the semiconductor material of Mishurnyi, as it has been shown to be a known etchant in the art of forming desired InGaAsSb, laser structures. Although Wu et al. may not specifically teach that the etchant is used on AlGaInAsSb structures, a routineer in the art would have appreciated the work since Wu et al. teaches etching InGaAsSb, and would have applied this known etching composition to Mishurnyi in order to obtain a desired structure. Wu et al. has shown that these etching techniques for compound semiconductors of the AlGaIn series are beneficial and a known technique in the art.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mishurnyi et al. (Multicomponent Sb-Based solid solutions grown from Sb-Rich liquid phases") in view of Wu et al. ("Sulphur Passivation of the InGaAsSb/GaSb Photodiodes") further in view of Boos et al. (US 5,798,540).

Mishurnyi et al. teach a system comprising an AlGaInAsSb quinary semiconductor material (abstract) with a composition of $Al_xGa_{1-x-z}In_zAs_ySb_{1-y}$ (page 38 second paragraph), wherein x, y, and z fall within the applicants instantly claimed ranges. Mishurnyi teaches using the layer in lasers. Mishurnyi does not teach that the system comprises a wet etchant for wet acid etching a portion of the semiconductor

material. Wu et al. teach an electronic semiconductor device comprising layers of InGaAsSb, for use in LED's, lasers, Photodiodes, etc. (pg 1303, col. 1, lines 1-4). To form these structures Wu et al. teaches etching the layers with a wet etching solution comprising, HF:Tartaric acid:H₂O₂:H₂O in amounts of (5ml:1.2g:10ml:160ml) (pg 1303, col. 1).

As described above this results in a wet acid etchant comprising organic acid; an oxidizing agent in an amount of 8 weight percent; hydrofluoric acid; and water.

Wu, fails to teach an oxidizing agent in an amount of 0.4-5.3 weight percent.

Boos et al. teach a wet acid etchant, comprising hydrofluoric acid, an organic acid and an oxidizing agent such as hydrogen peroxide, used to etch similar materials to those taught by Wu and Mishurnyi et al., i.e. AlGaAsSb, InAlAsSb, InAs, GaSb, etc. (Boos et al., abstract, col. 3, lines 38-53). Boos et al. teach that hydrogen peroxide in the etchant is believed to oxidize the surface to be etched and hydrofluoric acid is believed to etch the oxidized layer. The etch rate varies directly with the relative amount of Hydrogen peroxide in the etchant. Depending upon the relative amounts of the components in the etchant the etch rate is between 6 and 60 microns/minute. (Boos et al., col. 4, lines 54-68). Thus Boos teaches that adjusting the amounts of hydrogen peroxide, and hydrofluoric acid in a wet etchant system, is well within the grasp of a routineer in the art., and that by doing so, one could achieve desired etch rates.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to alter the amounts of the components of the etching system taught

by Wu, to include hydrogen peroxide, in amounts of 0.4-5.3 weight percent, in order to obtain desired etch rates.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mishurnyi and Wu, or Mishurnyi, Wu, and Boos, as applied to claim 24 above, further in view of Garbuzov et al. ("2.3-2.7 micron Room temperature CW operation of InGaAsSb-AlGaAsSb Broad Waveguide SCH-QW Diode Lasers").

Wu teach an etchant for semiconductor materials. Mishurnyi teach an AlGaInAsSb layer as described above. Mishurnyi do not specifically teach doping the layer. However it is known in the art and taught by Garbuzov et al., that to achieve desired electrical properties doping GaAlIn series layers with Te in order to achieve n-type layers, and to use Be to achieve p-type layers. It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to dope the layers as taught by Mishurnyi with known dopants such as Te for n-type doping and Be for p-type doping, in order to obtain desired electrical properties as is known in the art.

Claims 26-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mishurnyi, Wu, and Garbuzov, or Mishurnyi, Wu, Boos, and Garbuzov as applied to claim 25 above, further in view of Deryagin et al., "High Quality AlGaAsSb, AlGaAsSb and InGaAsSb epitaxial layers Grown by LPVE from Sb-rich melts".

Mishurnyi et al. do not disclose the type of lasers these layers may be used in. Deryagin et al. teach that AlGaAsSb layers may be used in lasers, photodiodes, and Led's, (introduction). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the present invention was made to use the semiconductor device and etching steps of Mishurnyi, Wu, and Garbuzov to form and use the semiconductor material as a layer in a LED, Photodiode, sensor or laser, as is known in the art.

Regarding claims 29-30, the semiconducting structure, is more than capable of being used as a part of a VCSEL or a PCDFL as is known in the art.

Response to Arguments

Applicant's amended claim 24 to include weight percents for the oxidizing agent. These weight percents fall outside the weight percents taught by Wu et al., however are sufficiently close to establish a prima facie case of obviousness. Furthermore, it is the Examiner's position that adjusting these weight percents is well known in the art and the claimed weight percents are easily obtainable, and would have been an obvious modification of Wu's etchant, for one of routine skill in the art.

The arguments with respect to claims 24-31 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JONATHAN C. LANGMAN whose telephone number is (571)272-4811. The examiner can normally be reached on Mon-Thurs 8:00 am - 6:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on 571-272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JCL
/Jonathan C Langman/
Examiner, Art Unit 1784

